T-195
TRANSMITTER

DEPARTMENT OF THE ARMY TECHNICAL MANUAL TM-5820-295-20

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER TO 31R2-2GRC19-32

ORGANIZATIONAL MAINTENANCE

RADIO SET AN/GRC-19

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

3 JUNE 1960

WARNING

DON'T TAKE CHANCES

EXTREMELY DANGEROUS VOLTAGES
EXIST IN THE FOLLOWING UNIT
OF RADIO SET AN/GRC–19

TRANSMITTER T–195/GRC–19	1,000-volts dc 10,000-volts rf

*TM 11–5820–295–20/TO 31R2–2GRC19–32

TECHNICAL MANUAL

No. 11–5820–295–20

TECHNICAL ORDER

No. 31R2–2GRC19–32

DEPARTMENTS OF THE ARMY

AND THE AIR FORCE

WASHINGTON 25, D. C., *3 June 1960*

RADIO SET AN/GRC–19

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***This manual supersedes so much of TM–11–274, 27 April 1954, including C1, 11 January 1956; C2, 27 July 1956; C3, 7 February 1957; and C4, 17 May 1957, as is applicable to the organizational maintenance of the equipment.**

CHAPTER 1
MAINTENANCE INSTRUCTIONS

Section I. GENERAL

1. Scope

a. This manual covers second echelon maintenance of Radio Set AN/GRC–19. The operating instructions for this equipment are contained in TM 11–5820–295–10.

b. Second echelon maintenance of Radio Set AN/GRC–19 consists of the following:

(1) Preventive maintenance (par. 3).
(2) Visual inspection (par. 4).
(3) Troubleshooting (par. 5).
(4) Replacement of defective tubes (par. 6).
(5) Replacement of defective dial lamps (par. 7).
(6) Replacement of defective fuses (par. 8).

c. The differences between models of components of this set are not significant to second echelon personnel.

d. Forward comments concerning this manual to the Commanding Officer, U. S. Army Signal Publications Agency, Fort Monmouth, N. J.

Note. For applicable forms and records, see paragraph 2, TM 11–5820–295–10.

2. Tools, Materials, and Test Equipment Required

A list of parts normally stocked for unit repairman's maintenance is contained in TM 11–5820–295–20P. The tools, materials, and test equipment required for unit repairman's maintenance are listed below.

a. Tools.

(1) Tool Equipment TE–41.
(2) Seven-pin and nine-pin tube pullers (fig. 3 and 4) stored in both the receiver and the transmitter.

b. Materials.

(1) Cleaning Compound (Fed. stock No. 7930–395–9542).
(2) Cleaning cloth.
(3) Fine sandpaper.
(4) Gasket shellac.

c. Test Equipment. The only test equipment required is Multimeter AN/URM–105.

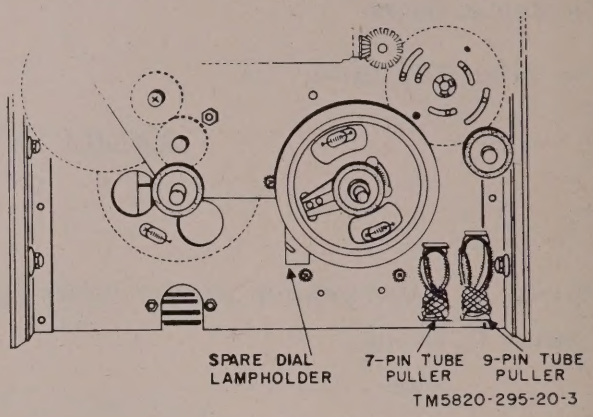

Figure 1. Gear plate, front panel removed, showing location of special tools supplied with receiver.

3. Preventive Maintenance

a. DA Form 11–238. DA Form 11–238 (fig. 2 and 3) is a preventive maintenance checklist to be used by the unit repairman. Items not applicable to the equipment are lined out in the figures. References in the item block in the figures are to the paragraph that contains additional maintenance information pertinent to the particular item. Additional preventive maintenance information concerning items 2, 3, 6, and 7 on DA Form 11–238 will be found in the preventive maintenance portion of TM 11–5820–295–10. Instructions for the use of the form appear on the form.

b. Items. The information shown in this subparagraph is supplementary to DA Form 11–238. The item numbers correspond to the ITEM numbers on the form. Do not remove any subchassis in the receiver or transmitter to inspect components.

Item	Maintenance procedures
8	Check Rope RP–5, used to tie down whip antenna, for cuts or fraying. Check antenna guy wires for damage, if Antenna Group AN/GRA–12 is used.
9	Check Bag CW–206/GR for mildew, tears, or fraying.

ADDITIONAL ITEMS FOR 2D AND 3D ECHELON INSPECTIONS	CONDITION
26. INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS ~~AND REFLECTORS~~.	✓
27. CHECK FOR NORMAL OPERATION.	✓
28. ~~BEFORE SHIPPING OR STORING~~, ~~REMOVE BATTERIES~~	

IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING THE INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

FOLD

MAINTENANCE CHECK LIST FOR SIGNAL EQUIPMENT

SOUND EQUIPMENT, RADIO, DIRECTION FINDING
RADAR, CARRIER, RADIOSONDE AND TELEVISION

(AR 750-625)

EQUIPMENT NOMENCLATURE

RADIO SET AN/GRC-19

EQUIPMENT SERIAL NUMBER

0000

INSTRUCTIONS

This form may be used for a period of one month by using the correct dates and weeks of the month. It is to be used as a Preventive Maintenance check list for Signal equipment in actual use, or for a check on equipment prior to issue.

1. For detailed Preventive Maintenance instructions see:
   a. The Technical Manual *(in TM 11 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   b. The Supply Bulletin *(SB 11-100 series)* for the equipment. *(See DA Pamphlet Number 310-4)*
   c. The Department of the Army Lubrication Order. *(See DA Pamphlet Number 310-4)*

2. The following action will be taken by either the Communications Officer/ Chief for 1st echelon, or the Inspector for higher echelon:
   a. Enter Equipment Nomenclature and Serial Number.
   b. Strike out items that do not apply to the equipment.

3. Operator/Inspector will enter in the columns entitled CONDITION, on the proper line, a notation regarding the condition, using symbols specified under LEGEND.

4. After operator completes each daily inspection he will initial over the appropriate dates under "Daily Condition for Month", then return form to his supervisor.

TYPE OF INSPECTION

OPERATOR	2/3 ECHELON	DATE	SIGNATURE
	←	2 Mar 1960	John Jonesberg

4

DA FORM 1 MAY 57 11-238

REPLACES DA FORMS 11-238, 1 NOV 55; 11-239, 11-244, 11-245, 11-248, 11-249, 11-250, AND 11-251; WHICH ARE OBSOLETE.

Figure 2. DA Form 11-238, pages 1 and 4.

LEGEND for marking conditions:
Satisfactory, ✓.
Adjustment, Repair or Replacement required, X.
Defect corrected, (X).

DAILY CONDITION FOR MONTH OF MARCH 1960

NO.	DAILY ITEM	1 17	2 18	3 19	4 20	5 21	6 22	7 23	8 24	9 25	10 26	11 27	12 28	13 29	14 30	15 31	16	2D ~~3D~~ ECHELON
1.	COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT. *(Transmitter, receiver, carrying cases, wire, cables, microphones, tubes, spare parts, technical manuals).*																	✓
2.	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONES, HEADSETS, KEYS, JACKS, PLUGS, COMPONENT PANELS.																	✓
3.	INSPECT CONTROLS FOR NORMAL OPERATION. TAP CONTROLS LIGHTLY FOR EVIDENCE OF CUT-OUT FROM LOOSE CONTACTS.																	✓
4.	CHECK FOR NORMAL OPERATION OF EQUIPMENT. BE ALERT FOR UNUSUAL OPERATION OR CONDITION.																	✓

WEEKLY	CONDITION EACH WEEK 1ST	2D	3D	4TH	5TH	2D ~~3D~~ ECH
5. CLEAN AND TIGHTEN EXTERIORS OF CASES, ~~RACKS~~, MOUNTS, TRANSMISSION LINES.						✓
6. INSPECT CASES, MOUNTS, ~~ANTENNA TOWERS~~ AND EXPOSED METAL SURFACES FOR RUST, CORROSION.						✓
7. INSPECT CORDS, CABLE, WIRE, SHOCK MOUNTS FOR CUTS, KINKS, BREAKS, FRAYING, UNDUE STRAIN.						✓
8. CHECK ANTENNA GUY WIRES FOR PROPER TENSION OR DAMAGE. PAR. 3						✓
9. INSPECT CANVAS AND LEATHER ITEMS FOR MILDEW, TEARS, FRAYING. PAR. 3						✓
10. INSPECT ACCESSIBLE ITEMS FOR LOOSENESS: SWITCHES, KNOBS, JACKS, CONNECTORS, RELAYS, TRANSFORMERS, MOTORS, PILOT LIGHTS, BLOWERS, ETC. PAR. 3						✓
11. CLEAN AND/OR INSPECT AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS.						✓
12. ~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, SPECIFIC GRAVITY, DAMAGED CASES. INSPECT DRY BATTERIES FOR LEAKAGE.~~						

ADDITIONAL ITEMS FOR 2D ~~AND 3D~~ ECHELON INSPECTIONS	CONDITION
13. INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHER-PROOFING, TEARS, FRAYING.	✓
14. ~~CHECK TERMINAL BOX COVERS FOR CRACKS, DIRT, LEAKS, DAMAGED GASKETS, GREASE.~~	

ADDITIONAL ITEMS FOR 2D ~~AND 3D~~ ECHELON INSPECTIONS	CONDITION
15. INSPECT SEATING OF READILY ACCESSIBLE PLUCK-OUT ITEMS: TUBES, LAMPS, FUSES, CRYSTALS, CONNECTORS, ~~VIBRATORS, PLUG-IN COILS.~~	✓
16. ~~INSPECT RELAYS AND CIRCUIT BREAKERS FOR LOOSE MOUNTINGS, BAD CONTACTS, MIS-ALINEMENT OF CONTACTS AND SPRINGS, PROPER SPRING TENSION.~~	
17. INSPECT VARIABLE CAPACITORS FOR DIRT, ~~MIS-ALINEMENT OF PLATES~~, LOOSE MOUNTINGS, MOISTURE. PAR. 3	✓
18. INSPECT RESISTORS, BUSHINGS AND INSULATORS FOR CRACKS, CHIPPING, BLISTERING, MOISTURE, DISCOLORATION. PAR. 3	✓
19. CLEAN AND TIGHTEN SWITCHES, ~~TERMINAL BLOCKS, BLOWERS, RELAY CASES AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.~~ PAR. 3	✓
20. INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR. 3	✓
21. INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR DIRT, CORROSION, LOOSE CONTACTS. PAR. 3	✓
22. INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS AND RHEOSTATS FOR OVERHEATING AND OIL LEAKAGE. PAR. 3	✓
23. ~~INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS FOR BRUSH WEAR, SPRING TENSION, ARCING AND FITTING OF COMMUTATOR.~~	
24. ~~INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.~~	
25. INSPECT WATERPROOF GASKETS FOR LEAKS, WORN OR LOOSE PARTS.	✓

CONTINUED ON PAGE 4

2 3

☆ GPO: 1957 O—427034

Figure 3. DA Form 11-238, pages 2 and 3.

4. Visual Inspection

Many of the faults in the radio set may be found by inspecting the system components. When troubleshooting, get as much information as possible from the operator as to the operation of the set before trouble appeared. Before starting a detailed examination of the component parts, check for the following common troubles.

Caution: **When servicing the transmitter, be careful with the power-supply circuits and the plate circuits. The high voltages in these circuits can cause serious injury or death. When the transmitter is taken out of its case for servicing, connect a ground wire to the main frame before connecting the power cable. Use #12 AWG wire (or larger) for the ground wire. Make sure that the transmitter is turned off and disconnected from the power source before working on any high-voltage circuits. Discharge the high-voltage capacitors by shorting them to ground with a grounding rod. The grounding rod should have an insulated handle. Use a strong alligator clip and a copper-braid strap to make a good ground connection.**

a. Improper setting of the switches and controls (TM 11–5820–295–10).

b. Improper connection of the cables, headset cord, or antenna lead-in wire (TM 11–5820–295–10).

c. Worn, broken, or disconnected cables, plugs, or headset cord.

d. Grounded or broken antenna or antenna lead-in wire.

e. Poor ground connections.

f. Transmitter interlock switch S611 open. (Transmitter case is not screwed on tightly.)

g. Burned-out fuses. (This usually indicates other troubles.)

h. Loose or broken wires.

i. Improper seating of cables (between the subchassis) in the transmitter or in the receiver.

j. Check for defective tubes (par. 6).

k. If a transmitter that was used on a voice or continuous wave (cw) circuit is installed on a circuit using FSK operation, see that plug P801 is in jack J101 and that plug P601 is in jack J620 in the transmitter.

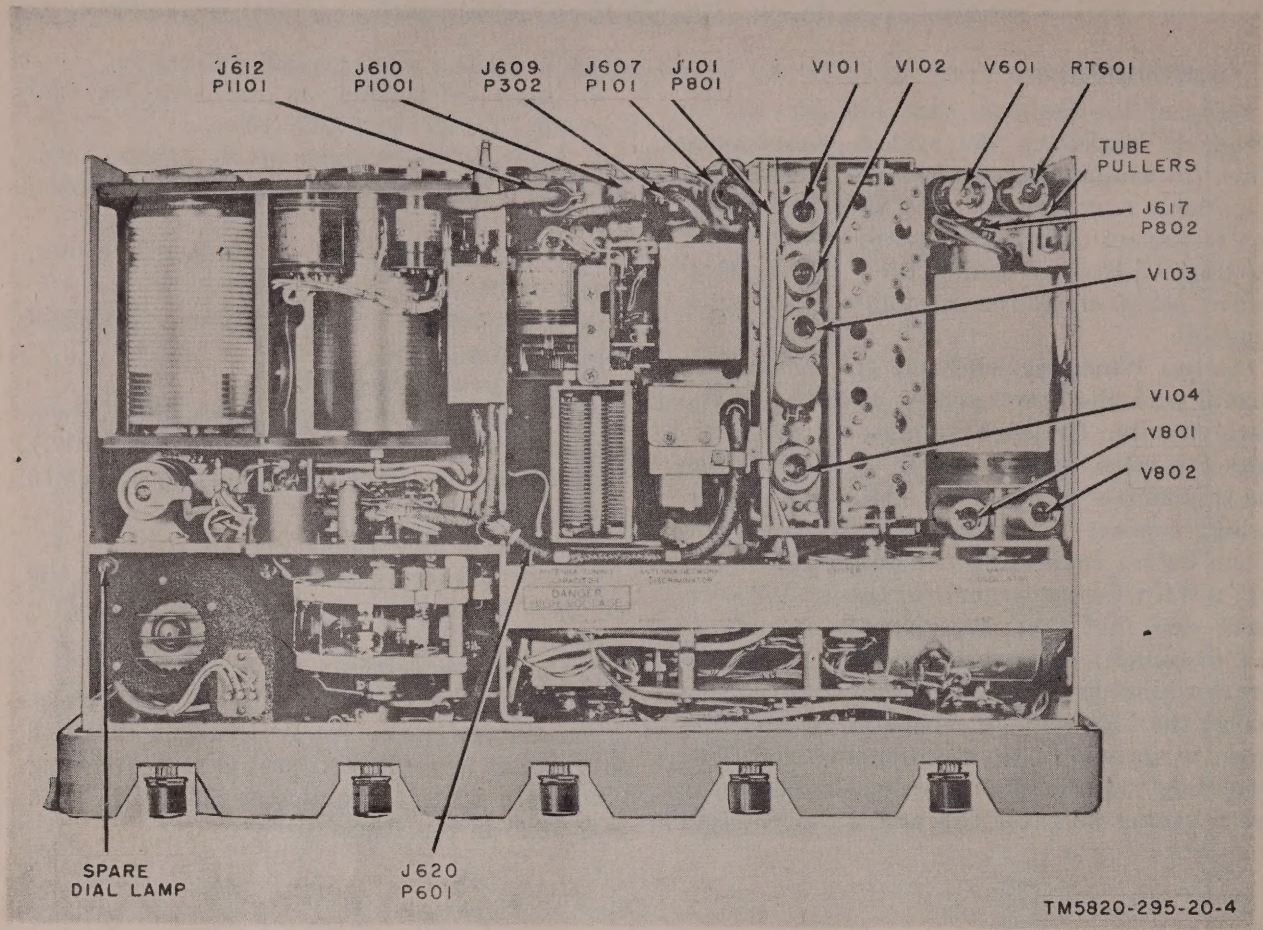

Figure 4. Transmitter tube and plug locations, top view.

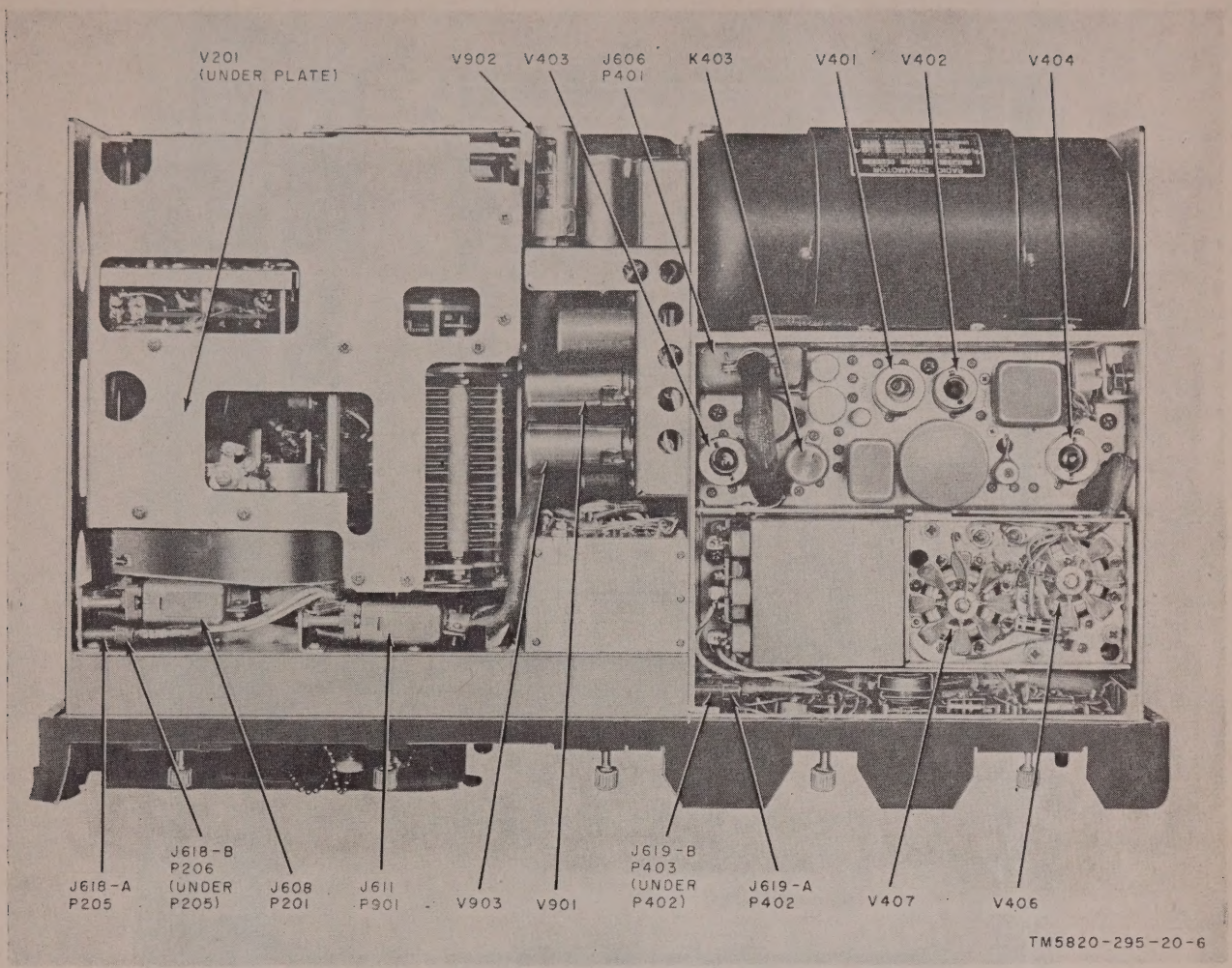

Figure 5. Transmitter tube and plug locations, bottom view.

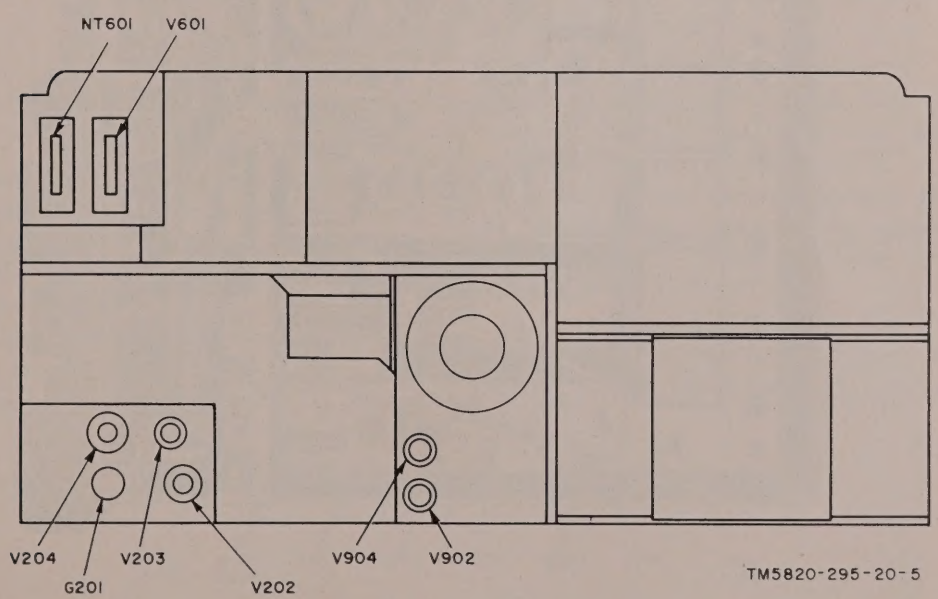

Figure 6. Transmitter tube and plug locations, rear view.

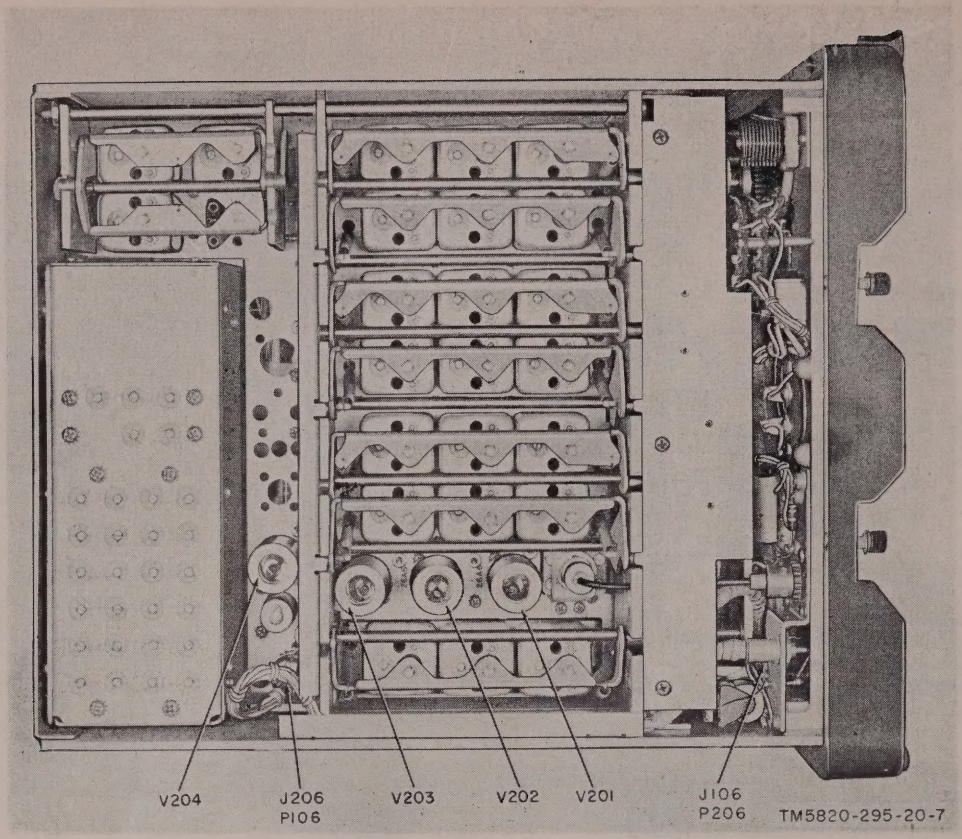

Figure 7. Receiver tube and plug locations, top view.

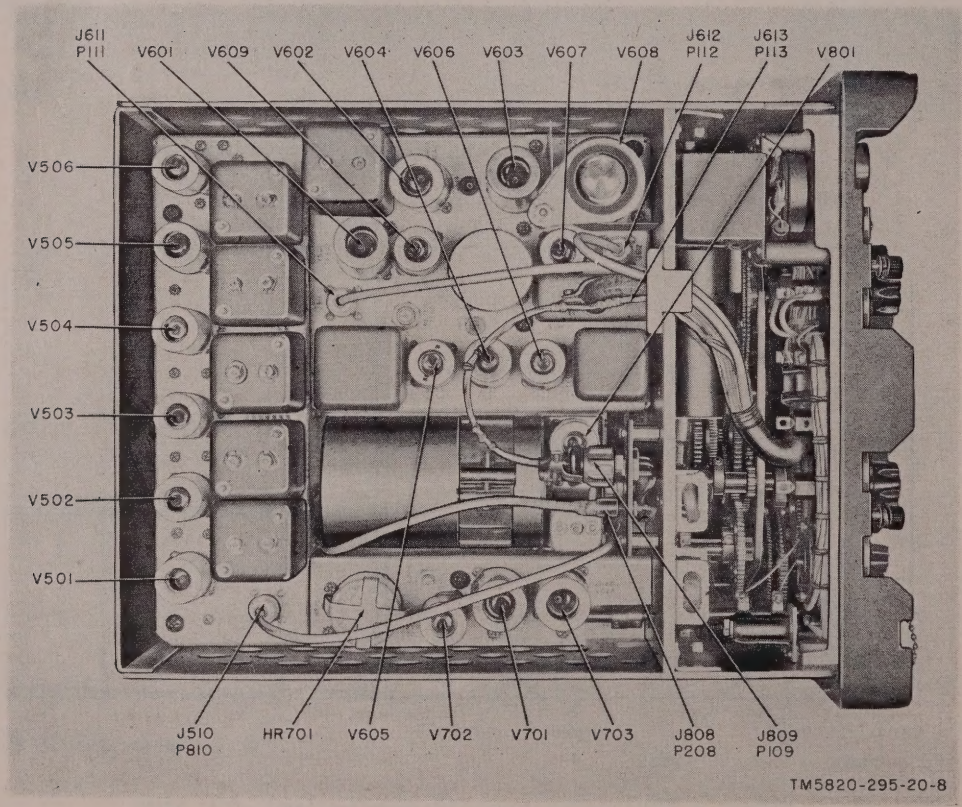

Figure 8. Receiver tube and plug locations, bottom view.

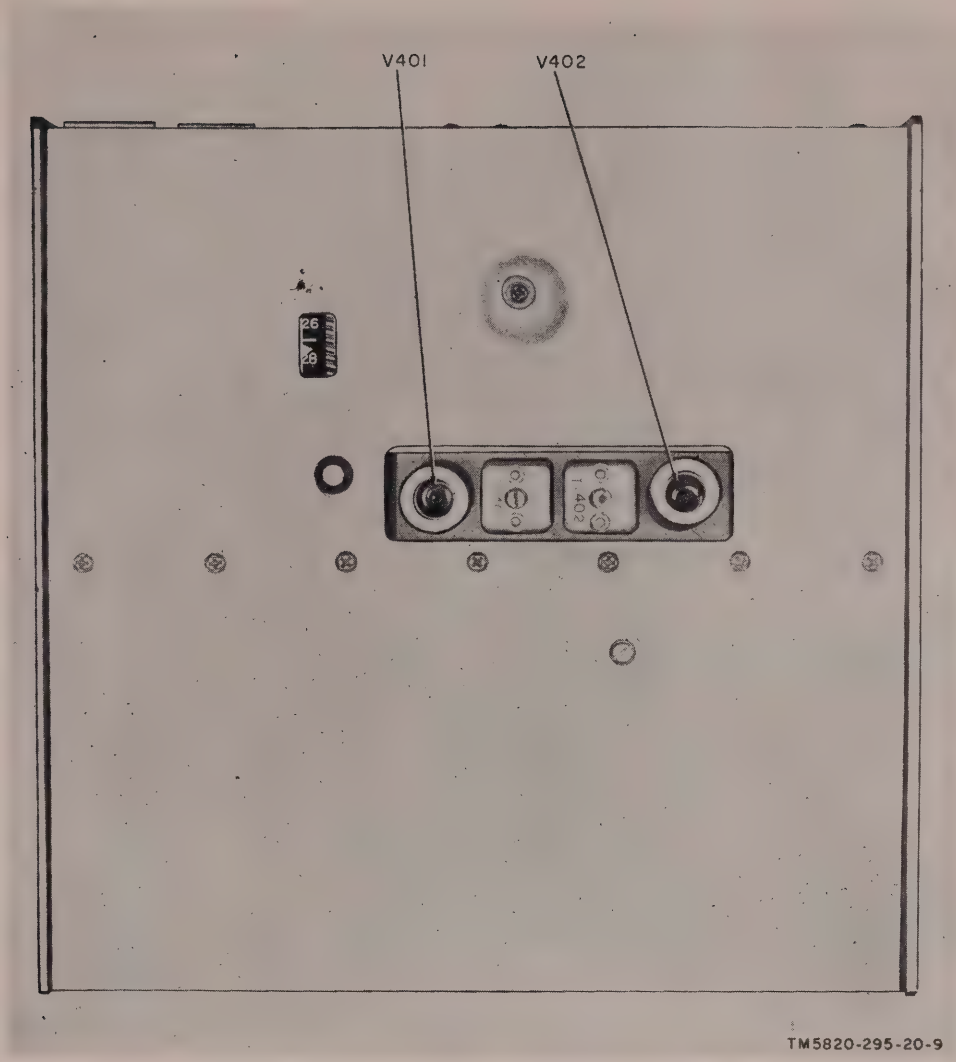

Figure 9. Receiver tube locations, rear view.

5. Equipment Performance Checklist

a. General. The equipment performance checklist is used to check the equipment performance systematically. All corrective measures which the unit repairman can perform are given in the *Corrective measures* column. When using the checklist, start at the beginning and follow each step in order. If the corrective measures indicated do not correct the trouble, refer the equipment to the next higher maintenance echelon. Note the trouble symptom on the repair tag and indicate what corrective measures were taken.

Caution: **Before the transmitter is turned on for troubleshooting or testing, make sure that it is connected to an antenna or a dummy antenna.**

b. Procedure. Check Radio Set AN/GRC–19 as described in (1) below. Check transmitter Control C–822/GRC–19 as described in (2) below.

Procedure (cont)

	Step	Unit	Action	Normal indication	Corrective measures
	1	Transmitter	Set the SERVICE SELECTOR switch at OFF.		
	2	Transmitter	Set the DIAL DIM switch at FULL.		
	3	Transmitter	Set the RELAY NORMAL DUPLEX switch at NORMAL.		
	4	Transmitter	Set the TEST METER switch at BATT.		
	5	Transmitter	Lock the locking bar on the BAND SELECTOR switch.		
	6	Transmitter	Lock the locking bar on the TUNING CONTROL.		
P					
R	7	Transmitter	Set the PRESET CHANNELS switch at the desired channel.		
E					
P	8	Receiver	Set the function switch at OFF.		
A	9	Receiver	Set the BFO switch at OFF.		
R	10	Receiver	Set the AGC switch at ON.		
A	11	Receiver	Set the AF GAIN control at the center of its range.		
T	12	Receiver	Set the BAND WIDTH switch at 8.		
O	13	Receiver	Set the DIAL DIM switch at ON.		
R	14	Receiver	Turn the RF GAIN control all the way to the right (clockwise).		
Y					

Procedure (cont)

	Step	Unit	Action	Normal indication	Corrective measures
	15	Transmitter	Set the SERVICE SELECTOR switch at CALIB. (Allow the equipment to warm up for 5 minutes.)	Test meter indicates normal battery voltage and the dial lamps light.	If there is no indication, check front-panel FUSE 15AMP 24-VOLT, power cable connections, and dial lamps.
					If fuse keeps burning out, the transmitter is probably defective. Refer to TM 11-806.
					If meter reading is incorrect, check the voltage of the power source. (Adjust to 28.5v.)
S				Movement of air is felt at the air vents.	Check for proper seating of J610 in P1001 and J612 in P1101 (fig 4).
T				Lv dynamotor starts within 40 seconds ±10 seconds.	Make sure that the interlock switch is closed, by tightening the 16 Allenhead screws.
A					
R					Check for proper seating of J606 in P401 (fig. 5).
T					Check dynamotor fuse F602 (10 amp).
	16	Receiver	Set the function switch at STANDBY.	Dial lamps light.	Check the LINE 5AMP fuse and the dial lamps.
					Check the interconnecting cable between the transmitter RECEIVER CONT receptacle and the receiver POWER INPUT-TRANS CONT receptacle.
					Check for proper seating of J106 in P206 (fig. 7).

b. Procedure (cont)

	Step	Unit	Action	Normal indication	Corrective measures
EQUIPMENT PERFORMANCE	17	Transmitter	Set the TEST METER switch at PA GRID.	Test meter indicates within shaded area marked PA GRID.	Check these connectors for proper seating: J101 in P801 (fig. 4); J607 in P101; J617 in P802; J608 in P201 (fig. 5). If the test-meter reading is low, check these tubes by substitution: V801 (fig. 4), V802, V101, V102, V103, V104, V601, and V201 (fig. 5 and 7).
	18	Transmitter	Set the PRESET CHANNELS switch at M.		
	19	Transmitter	Unlock the locking bar on the BAND SELECTOR switch.		
	20	Transmitter	Unlock the locking bar on the TUNING CONTROL.		
	21	Transmitter	Turn the BAND SELECTOR switch to each of the 10 bands in turn, and, while on each band, turn the TUNING CONTROL to the low and high end of the band.	Test meter indicates within the shaded area marked PA GRID.	Check these tubes by substitution: V101, V102, and V103 (fig. 4).

	Step	Unit	Action	Normal indication	Corrective measures
EQUIPMENT PERFORMANCE	22	Transmitter	Set the SERVICE SELECTOR switch at CW.	Hv dynamotor starts within 10 seconds.	Check dynamotor fuse F603 (30 amp).
	23	Transmitter	Set the TEST METER switch at PA CATH.	Test meter indicates zero.	Check tube V202 (fig. 7).
	24	Transmitter	Hold the TEST KEY at ON.	TUNING INDICATOR lights, goes out, lights again, and remains lighted after a slight delay of not more than 30 seconds.	Check the TUNING INDICATOR lamp. Check the antenna connections and the ground connections.
				Note. If the transmitter has been manually tuned from one frequency to another in the same band, or manually tuned to the same frequency in another band, the TUNING INDICATOR may not light or may light and remain lighted. In this case, switch the BAND SELECTOR switch to an adjacent band and back again, and wait for the tuning cycle to be completed.	Check these connectors for proper seating: J607 in P101, J609 in P302 (fig. 4), J611 in P901, J608 in P201, J618-A in P205, and J618-B in P206 (fig. 5). Check these tubes by substitution: V201, V901, and V903 (fig 5); V202, V203, V204, V902, and V904 (fig. 6). If Antenna Group AN/GRA-12 is being used, change the length of the antenna slightly.
				400-cycle sidetone can be heard in the headset.	Check the headset and the headset cord. Check tube V403 (fig. 5). Check for proper seating of J606 in P401 (fig. 5).
	25	Transmitter	Turn the BAND SELECTOR switch to each one of the 10 bands in turn, and, while on each band, turn the TUNING CONTROL to the low and high end of the band. Hold the transmitter TEST KEY at the ON position after each frequency setting. (Wait until each tuning cycle is finished for each frequency setting before proceeding to the next one.)	After the tuning cycle is finished. the test meter indicates within the shaded area marked PA CATHODE The TUNING INDICATOR will stay lighted and the 400-cycle sidetone is heard in the headset. *Note.* Refer to note in No. 24 above.	Same as step No. 24 above.
	26	Transmitter	Release the TEST KEY.	The TUNNING INDICATOR is not lighted. The test meter reads zero. The 400-cycle sidetone signal is not heard in the headset.	
	27	Telegraph key	Hold the telegraph key closed.	The test meter indicates within the shaded area marked PA CATHODE. The TUNING INDICATOR stays lighted. *Note.* Refer to the note in step No. 24 above. The 400-cycle sidetone signal is heard in the headset.	Check the telegraph key and the telegraph key cable.

	Step	Unit	Action	Normal indication	Corrective measures
	28	Telegraph key	Release the telegraph key.		
	29	Transmitter	Set the SERVICE SELECTOR switch at STAND BY.	The dynamotors stop. The test meter reads zero. The TUNING INDICATOR is not lighted. No sound is heard in the headset.	
	30	Transmitter	Set SERVICE SELECTOR switch at VOICE/FSK	The dynamotors do not start. The TUNING INDICATOR is not lighted. The test meter reads zero.	
	31	Microphone	Press the microphone switch	The dynamotors start. The TUNING INDICATOR stays lighted. *Note.* Refer to the note in step No. 24 above.	Check these connectors for proper seating: J606 in P401. (fig. 5).
EQUIPMENT PERFORMANCE			Talk into the microphone. Speak normally and hold the microphone about 2 inches from the lips.	The test meter indicates in the shaded area marked PA CATHODE, and the pointer moves slightly while the operator is talking. The audio level meter reads up to 100 on the peaks. The voice sidetone signal is heard in the headset.	Check these tubes by substitution: V401, V402, V403, V404, V406, and V407 (fig. 5). Check the microphone and the microphone cord.
	32	Transmitter	Lock the locking bar on the BAND SELECTOR switch.		
	33	Transmitter	Lock the locking bar on the TUNING CONTROL.		
	34	Transmitter	Press the reminder spring on the PRESET CHANNELS switch. Turn the switch from the M position to each of the positions which have channels preset. At each position, check for accuracy the reading on the frequency indicator. (Wait until the drive motor stops before turning the PRESET CHANNELS switch to a new channel.)	As the switch is set at each channel, the BAND SELECTOR switch and the TUNING CONTROL will turn. This will tune the transmitter to a frequency that is shown on the frequency indicator. Within limits, the reading on the frequency indicator will agree with the frequency written on the chart for each channel.	If the frequency indicator shows a frequency that differs by more than 20 kc from the frequency assigned to the channel, or if there is any doubt as to the true output frequency, recalibrate the channel. Refer to TM 11–806.
	35	Transmitter	Set the DIAL DIM switch at OFF.	The dial lamps are not lighted.	
	36	Transmitter	Set the DIAL DIM switch at DIM.	The dial lamps light dimly.	Replace the dial lamps that do not light.
	37	Transmitter	Set the DIAL DIM switch at FULL.	The dial lamps light fully.	
	38	Receiver	Set the function switch at NORMAL.		

	Step	Unit	Action	Normal indication	Corrective measures
	39	Receiver	Set the MEGACYCLES control to each band in turn. Turn the KILOCYCLES control through its entire range at each setting of the MEGACYCLES control. Adjust the MEGACYCLES and KILOCYCLES controls to receive a voice signal.	A signal or a rushing noise is heard in the headset, and the CARRIER LEVEL meter shows the strength of the received signal or noise. CARRIER LEVEL meter rises and dips as the KILOCYCLES control is varied.	If nothing is heard in the headset, and the CARRIER LEVEL METER does not indicate, check PLATE ½ AMP fuse (on the front panel). If the meter does indicate, check the headset and its connections. Check the rf cable connections and the transmitter antenna connections. Check the seating of the connecting cables between the subchassis.
	40	Receiver	Turn AF GAIN control through its entire range.	The signals heard in the headset become louder as the control is turned to the right clockwise.	Check these tubes by substitution: V603, V606, V607, and V608 (fig. 8).
EQUIPMENT PERFORMANCE	41	Receiver	Turn the ANT TRIM control through its entire range.	The CARRIER LEVEL meter shows increasing and decreasing signal strength. (Leave the control set for the greatest signal strength.)	Check the following tubes by substitution: V201, V202, V203, V204, V501, V502, V503, V504, V505, V609, and V801 (fig. 7 and 8).
	42	Receiver	Turn the BAND WIDTH switch from 8 to 4KC, to 2. Turn the BAND WIDTH switch to 8.	The selectivity becomes sharper. This is indicated by less background noise in the 4KC position and the least background noise in the 2 position.	Check tube V503 (fig. 8).
	43	Receiver	Set the function switch at LIMITER. Set the function switch at NORMAL.	If noise and static are being received with the signal, the noise peaks are reduced in strength.	Check tube V603 (fig. 8).
	44	Transmitter	Hold the TEST KEY at ON.	The receiver is silenced; nothing is heard in the headset.	Check the interconnecting cable between the TRANSMITTER RECEIVER CONT receptacle and the POWER INPUT-TRANS CONT receptacle on the receiver.
	45	Transmitter	Release the TEST KEY.	The signal is heard in the headset.	
	46	Transmitter	Disconnect the cable from the RECEIVER ANTENNA receptacle.		
	47	Receiver	Disconnect the cable from the ANT receptacle.		
	48	Receiver	Connect another antenna or a long wire to the ANT receptacle or ANT binding post.		
	49	Receiver	Set the function switch at NET.		

	Step	Unit	Action	Normal indication	Corrective measures
	50	Transmitter	Set the RELAY NORMAL DUPLEX switch at RELAY.	The receiver is not silenced; the signal is heard in the headset.	Check the interconnecting cable between the transmitter RECEIVER CONT receptacle and the POWER INPUT-TRANS CONT receptacle on the receiver.
	51	Transmitter	Set NORMAL RELAY DUPLEX switch at NORMAL.		
	52	Receiver	Set the function switch at SQ.		
	53	Receiver	Turn the RF GAIN control to the left (counterclockwise) so that the signal heard in the headset disappears. Rotate the control clockwise until the signal is barely heard.		
E					
Q	54	Receiver	Turn the KILOCYCLES control through its entire range.	There is a minimum of noise as the receiver is tuned between stations (or when listening to a voice-operated station) and the receiver is quiet between transmissions.	Check these tubes by substitution: V602 and V605 (fig. 8).
U					
I					
P					
M					
E					
N					
T	55	Receiver	Set the function switch at NORMAL.		
P	56	Receiver	Adjust the KILOCYCLES control until a voice signal is heard in the headset.		
E					
R					
F					
O	57	Receiver	Set the AGC switch at OFF.	The signal heard in the headset increases in strength.	Check these tubes by substitution: V601, and V602 (fig. 8).
R					
M					
A	58	Receiver	Set the BFO switch at ON.		
N	59	Receiver	Adjust the KILOCYCLES control until a cw signal is heard in the headset.	Sharp, clear cw signals are heard in the headset.	Check tube V504 (fig. 8).
C					
E	60	Receiver	Turn the BFO PITCH control through its entire range.	The tone of the cw signal changes.	
	61	Receiver	Set the AGC switch at CAL		
	62	Receiver	Turn the KILOCYCLES control through its entire range.	A beat note is heard in the headset, and the CARRIER LEVEL meter pointer moves at every 100-kc point on the frequency indicator below 20 mc.	Check these tubes by substitution: V701, V702, and V703 (fig. 8).
	63	Receiver	Set the DIAL DIM switch at OFF.	The dial lamps are not lighted.	
	64	Receiver	Set the DIAL DIM switch at DIAL DIM.	The dial lamps light dimly.	Replace the dial lamps that do not light.
	65	Receiver	Set the DIAL DIM switch at ON.	The dial lamps light fully.	
	66	Receiver	Set the function switch at STAND BY.	The receiver is silenced; nothing is heard in the headset. The dial lamps stay lighted.	

	Step	Unit	Action	Normal indication	Corrective measures
S T O P	67	Transmitter	Set the SERVICE SELECTOR switch is OFF.	The transmitter is shut off.	
	68	Receiver	Set the function switch at OFF.	The receiver is shut off.	

Step	Action	Normal indication	Corrective measures
1	Set SERVICE SELECTOR switch at OFF.		
2	Set SERVICE SELECTOR switch at VOICE.	Movement of air is felt at the air vents.	Check the interconnecting cable between the transmitter REMOTE CONT receptacle and the Transmitter Control C–822/GRC–19.
3	Set PRESET CHANNELS switch at a position for which a channel has been preset.	BAND SELECTOR switch and TUNING CONTROL will turn. This will tune the transmitter to the frequency shown on the frequency indicator.	Check the interconnecting cable between the transmitter REMOTE CONT receptacle and the Transmitter Control C-822/GRC–19.
4	Press the microphone switch.	The dynamotors start. The TUNING INDICATOR stays lighted.	Check the interconnecting cable between the transmitter REMOTE CONT receptacle and the Transmitter Control C–822/GRC–19 and the TUNING INDICATOR lamp.
5	Talk into the microphone.	The test meter indicates in the shaded area marked PA CATHODE, and the pointer moves slightly while the operator is talking. The audio level meter reads up to 100 on the peaks. The voice sidetone signal is heard in the headset.	Check the interconnecting cable between the transmitter REMOTE CONT receptacle and the Transmitter Control C–822/GRC–19.
6	Set SERVICE SELECTOR switch ar OFF.		

6. Tube Testing and Replacement

a. General. Inspect all cabling, connections, and the condition of the equipment before attempting to replace any tubes. Try to isolate the trouble to a particular stage or section so that needless replacement and testing of tubes is avoided.

(1) If a tube tester is available, remove and test one tube at a time. *Do not discard tubes* merely because they fall *on, or slightly below,* the minimum acceptable value. These tubes may provide satisfactory performance for a long period of time while near this test value.

(2) If a tube tester is not available, troubleshoot the tubes by using the tube substitution method as follows:

(*a*) Replace the suspected tube with a tube known to be good condition. If the substituted tube does not correct the trouble, replace the original tube. Continue to substitute tubes until the trouble is corrected.

(*b*) Remove the tube shields by pressing down and turning one-fourth turn counterclockwise. Do not rock or rotate any tube when removing it. Pull the tube straight up; use the proper tube puller. Be sure that the corrugated metal inserts are in place when replacing the tube shields.

(3) Do not replace or discard tubes merely because they have been in use for some time. If the tube operates properly in the circuit, it should not be replaced.

(4) Only discard tubes when the defect is obvious, such as a broken envelope, open filament, broken pin, of if a tube tester or the equipment shows it to be defective.

b. Checking Tubes by Substituting Spares. Tune the receiver to a voice frequency that is not fading. Turn the AGC switch to ON, turn the function switch to NORMAL, and turn the RF GAIN control all the way to the right (clockwise). *Make the substitution one tube at a time.* Tap the tube under test; if noise or an abnormal change in volume is heard, replace the tube. Usually, a considerable decrease in the carrier level indicated on the meter for tubes in those stages up to and including the second if amplifier (or a noticeable decrease in volume or quality of the signal heard in the headset) indicates a weak or defective tube. However, different test results for the following tubes must be observed:

(1) When V609 (agc-if amplifier) is weak, an *increase* in volume and a *decrease* in the carrier level indicated on the meter will result.

(2) When V601 (if cathode follower) is weak, the signal from the IF OUT connector will be weak (indicated by the abnormal operation of the radio-teletype converter that is connected to this connector); when a very strong signal is received, the receiver may block and prevent passage of the signal to the IF OUT connector. When V602 (rf and if agc rectifier) is weak or defective, an *increase* in volume or a *lower* indication on the CARRIER LEVEL meter will result.

(3) A change in volume or quality of the output signal will result if V603A (detector) is defective. To test V603B noise limiter), tune the receiver away from the test signal a slight amount so that a noisy signal is received; then turn the function switch to LIMITER. The substituted tube should be effective in reducing the noise. To check V605 (squelch control), turn the function switch to SQ, and tune the receiver from one signal to another. As the receiver is tuned between signals, it should be silenced. After this test, return the function switch to NORMAL and retune the receiver to the test signal.

(4) When checking V604 (bfo), turn the BFO switch to ON, turn the BFO PITCH control, and listen for a changing beat note.

(5) To test V701, V702, and V703 (calibration-oscillator circuit), turn the AGC switch to CAL, and tune through *at least* eleven 100-kc calibration points in *each* band. A peak should be seen on the CARRIER LEVEL meter at each 100-kc point below 20 mc and the last two numbers on the frequency indicator should be 00 (two zeros).

c. Receiver Filament Circuits. When looking at glass tubes or (when feeling metal tubes) for burned-out filaments, it may be found that more than one tube is not lighted. This condition can be caused by one filament burning out in a circuit having two or three filaments in series. The tubes with the 26-volt filaments are connected in parallel directly across the 28-volt power source. However, those filaments that operate at a lower voltage are connected in series circuits, and may include two or three filaments. An open filament in one stage will cause another stage to appear defective. The table below lists the tubes in each series-filament circuit. Tubes not listed in the table have filaments connected directly across the 28-volt filament line. All tubes in each series circuit are located on the same subchassis. Refer to figures 7, 8, and 9 for tube locations.

Series filament circuits (receiver)

V401 and V402 (crystal-oscillator subchassis)
V601, V606 and V607 (af subchassis)
V602 and V603 (af subchassis)
V701 and V703 (calibration-oscillator subchassis)

Reference symbol	Use	Type	Location	Figure Reference
V201	1st rf ampl	26A6	Rf subchassis	7
V202	2d rf ampl	26A6		
V203	1st mixer	26C6		
V204	2d mixer	26C6		
V401	1st xtal osc	6AJ5	Xtal oscillator subchassis	9
V402	2d xtal osc	6AJ5		
V501	1st if ampl	26A6	If subchassis	8
V502	2d if ampl	26A6		
V503	3d if ampl	26A6		
V504	4th if ampl	26A6		
V505	5th if ampl	26A6		
V506	6th if ampl	26A6		
V601A	If cathode follower	12AU7	Af subchassis	8
V601B	1st rf age rect			
V602A	Rf and if age rect	12AU7		
V602B	Squelch rect			
V603A	Detector	12AU7		
V603B	Noise limiter			
V604	Bfo	26A6		
V605	Squelch control	6AJ5		
V606	1st of ampl	6AJ5		
V607	Phase inverter	6AJ5		
V608	2d of ampl	26A7		
V609	Age if ampl	26A6		
V701	Multivibrator	12AU7	Calibration oscillator subchassis	8
V702	200-kc xtal osc	26A6		
V703A	Harmonic ampl	12AU7		
V703B	Distorter			
V801	Vfo-mixer	26D6	Vfo-mixer subchassis	8

d. Receiver Tubes. The reference symbol, use, type, location, and figure reference of each of the 25 tubes in the receiver are listed in the following table:

e. Transmitter Filament Circuits (fig. 10). When visually inspecting the tubes for burned-out filaments, it may be discovered that more than one tube is not lighted. Eight main filament branches are fed from the 24-volt supply. If V203 is open, branch No. 1 will be entirely inoperative. If V204 is open, resistor R234 will limit the current through V203 making V203 inoperative, and R121 will limit the current through V101 if V102 or V103 is open. If V101, V102, or V103 is open, branch No. 2 will be inoperative. If V104 or V202 is open, branch No. 3 is inoperative. Branches No. 4 and No. 5 are similar series filament strings. The failure of either branch No. 4 or No. 5 does not make the other branch inoperative, but, if one of the tubes in the branch is open, the whole branch is inoperative. If V404 is open, branch No. 6 is inoperative. If V402, V401, or V403 is open, resistor R417 limits current though V404 making it inoperative. Branch No. 7 consists only of V201. This tube has a 26-volt filament and operates directly from the 24-volt supply through the low resistance of F602 and CR601. Branch No. 8 consists of V406 and V407 in parallel. Both V406 and V407 have 26-volt filaments and operate directly from the 24-volt supply through the low resistance of F602 and CR601. When SERVICE SELECTOR switch S606 is in STAND-BY position, the three tubes of branches No. 7 and No. 8 are connected to 24 volts, through R622 and R623. Because of the voltage drop across R623 and R622, the voltage to V201, V406, and V407 is reduced approximately 20 percent. Branches No. 7 and No. 8 are also

connected to 24 volts through CR601, F602, and contacts of dynamotor start relay K602 when the microphone switch or the key is closed. This arrangement allows full filament voltage to be applied during operation. During periods of standby, the back resistance of CR601 is high enough to prevent operation of the dynamotor. A defective fuse F601 or defective relay K608 will cause all filament branches to be inoperative. If F602 or CR601 are defective, the tubes in branches No. 7 and No. 8 will have filament voltage reduced at all times. Resistors R234, R121, and R417 also limit the current through the branches which they parallel.

Reference symbol	Use	Type	Location	Figure Reference
V101	1st multiplier	6AU6WA	Exciter subchassis	4
V102	2d multiplier	6AK6		
V103	3d multiplier	6AK6		
V104	Driver	5763		
V201	Power ampl	4X150D	Power-amplifier subchassis	5
V202	Clamper	5763		and
V203	3d servo ampl	6005/6AQ5W		6
V204A	1st servo ampl	5751		
V204B	2d servo ampl			
V401A	Preamplifier	12AT7	Modulator subchassis	5
V401B	1st audio ampl			
V402	Limiter	5726/6AL5W		
V403A	Sidetone ampl	12AT7		
V403B	Antenna delay			
V404A	2d audio ampl	5814A		
V404B	Phase inverter			
V406	Modulator	4X150D		
V407	Modulator	4X150D		
V601	Voltage regulator	0A2	Main frame	4
V801	Oscillator	5749/6BA6W	Master-oscillator subchassis	4
V802	Buffer ampl	5749/6BA6W		
V901A	1st phasing ampl	5751	Antenna-network and servo-ampl subchassis	5
V901B	2d phasing ampl			and
V902	3d phasing ampl	6005/6AQ5W		6
V903A	1st loading ampl	5751		
V903B	2d loading ampl			
V904	3d loading ampl	6005/6AQ5W		

f. Transmitter Tubes. The reference symbol, use, type, location, and figure reference of each of the 21 tubes in the transmitter are listed in the following table:

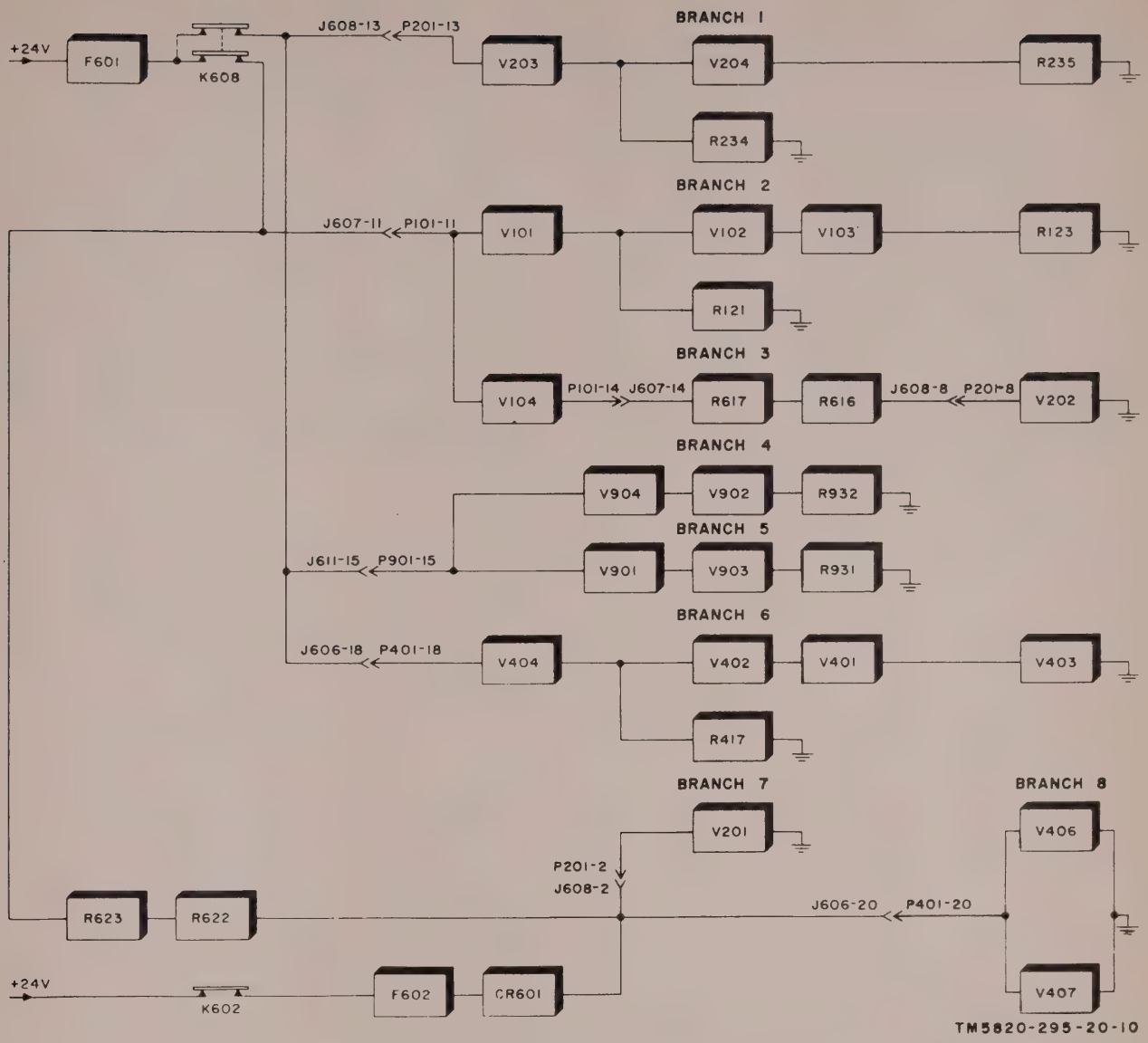

Figure 10. Filament circuits of transmitter, simplified block diagram.

g. Preferred-Type Tubes. The chart below lists the preferred-type tube for each nonpreferred-type tube. Do not use a nonpreferred-type tube to replace a preferred-type tube.

Nonpreferred-type tube	Preferred-type tube	Where used
6AU6	6AU6WA	First multiplier.
5814	5814A	Second audio, phase inverter stages.
12AT7	12AT7WA	Preamplifier, sidetone amplifier, and antenna delay stages.

7. Removal and Replacement of Dial Lamps

Note. When replacing the indicator windows, apply gasket shellac to the gaskets to keep the window watertight.

a. Transmitter. To remove dial lamp I601 from the BAND and CHAN indicator, remove the six screws that hold the indicator window and take off the window and its gasket. To remove the bayonet-type lamp, turn it to the left (counterclockwise). To remove dial lamps I602 and I603 from the frequency indicator, remove the 12 screws, and take off the window and its gasket. These lamps are removed in the same way as I601. A spare lamp

is located on the main frame of the transmitter (fig. 4). To reach this spare lamp, loosen the 16 Allen-head screws on the front panel and pull the transmitter partly out of its case. To replace TUNING INDICATOR lamp I605, turn the glass indicator jewel to the left (counterclockwise) and remove the lamp in the same way as the others.

b. Receiver. To remove dial lamps I201 and I202 from the frequency indicator, remove the 10 screws that hold the indicator window and take off the window and its gasket. To remove the bayonet-type lamps, turn them to the left (counterclockwise). A spare lamp is located on the main frame of the receiver (fig. 1). To reach this spare lamp, loosen the 16 Allen-head screws on the front panel, and pull it partly out of its case.

8. Removal and Replacement of Fuses

a. Transmitter. To remove FUSE 15AMP 24VOLT from the front panel, push in on the fuseholder cap and turn it to the left (counterclockwise). To replace fuses F602 and F603 on the front panel, slide the latch up on the DYNAMOTOR FUSES cover and remove the cover.

b. Receiver. To remove the LINE 5AMP and PLATE ½AMP fuses, push in on the fuseholder cap and turn it to the left (counterclockwise). Remove the spare SPARE 5AMP and SPARE ½AMP fuses in the same way.

CHAPTER 2
SHIPMENT AND LIMITED STORAGE

9. Disassembly of Equipment

The following instructions are recommended as a guide for preparing the radio set for shipment and storage.

a. Disconnection of Cables.

(1) Disconnect the telegraph key and all audio accessories from their receptacles on the units and coil the cords neatly.

(2) Disconnect all interconnecting cables between the units (TM 11–5820–295–10).

(3) Disconnect the antenna lead-in wire from the transmitter and antenna mast base, and coil the wire neatly.

(4) Disconnect the power cable from the transmitter and vehicle battery. Coil the cable neatly.

(5) Disconnect the grounding strap from the mounting to the vehicle.

b. Removal of Units.

(1) Loosen the three retaining clamps on the lower front edge of the transmitter. Slide the transmitter case forward until the lower rear edge slides out from under the four clamps at the rear of the mounting and remove the transmitter. Remove the receiver in the same way. There are only two retaining clamps and two rear clamps on the receiver side of the mounting.

(2) Unscrew the eight bolts and nuts that secure the mounting in place and remove the mounting.

c. Removal of Antenna.

(1) Untie Rope RP–5 from the top of the antenna and from the rear of the vehicle. Coil the rope neatly.

(2) Loosen the antenna sheath clamp and slide the clamp partly up the antenna.

(3) Slide the antenna cover partly up the antenna.

(4) Unscrew Mast Section MS–116–A section from the mast base.

(5) Slide the antenna cover and the antenna sheath clamp down and off Mast Section MS–116–A.

(6) Unscrew Mast Section MS–118–A from Mast Section MS–117–A.

(7) Unscrew the MS–117–A section from the MS–116–A section.

(8) Unscrew the MS–116–A sections from each other.

10. Repackaging for Shipment or Limited Storage

The exact procedure for repackaging depends on the material available and the conditions under which the equipment is to be shipped or stored. Adapt the procedures outlined below whenever possible. The information concerning the original packaging (TM 11–5820–295–10) will also be helpful.

a. Material Requirements. The following materials are required for packaging Radio Set AN/GRC–19. For stock numbers of materials, consult SB 38–100.

Material	Quantity
Waterproof wrapping paper.	75 sq. ft.
Fiberboard corrugated single face (flexible).	81 sq. ft.
Waterproof adhesive tape.	50 ft.
Steel strapping (5/8 x 0.020).	
Note. Steel strapping is required only for interheater shipments.	

b. Packaging. Package the components of Radio Set AN/GRC–19 as follows:

(1) *Technical manuals* (fig. 11). Package each technical manual within a close-fitting bag fabricated of waterproof wrapping paper. Seal the bag securely with water-proof, pressure-sensitive tape.

(2) *Bag CW–206/GR* (fig. 12). Place the minor components within the designated compartment of the bag. Fold the bag and secure it with its fastening devices. Wrap the bag with corrugated fiberboard and overwrap with waterproof wrapping paper. Secure the overwrap with waterproof, pressure-sensitive tape.

(3) *Radio Receiver R–392/URR* (fig. 11). Place the running spares for the receiver within Case CY–1298/URR. Close and secure the case lid with its fastening devices. Wrap the case with corrugated fiberboard. Secure the wrap with pressure-sensitive tape. Wrap the receiver with corrugated fiberboard. Secure the wrap with pressure-sensitive tape. Place the wrapped case and wrapped receiver together and wrap with corrugated fiberboard and overwrap with waterproof wrapping paper. Secure the overwrap with waterproof, pressure-sensitive tape.

(4) *Radio Transmitter T–195/GRC–19* (fig. 12). Place the running spares for the transmitter within Case CY–1451/GRC–19. Close and secure the case lid with its fastening devices. Make sure that the three air vents on the transmitter are closed (yellow side facing out). To close these vents, loosen the catches on each side of the vents, pull out the vents, and reverse them, and then secure the catches. Individually wrap each of the items listed below with corrugated fiberboard and secure the wrap with pressure-sensitive tape. Place the wrapped items together and wrap with corrugated fiberboard and overwrap with waterproof wrapping paper. Secure the overwrap with waterproof, pressure-sensitive tape.

(*a*) Case CY–1451/GRC–19.
(*b*) Cable Assembly CG–1127/U.
(*c*) Cable Assembly CX–1599/U.
(*d*) Cable Assembly CX–1852/U.
(*e*) Cable Assembly CX–2583/U.
(*f*) Radio Transmitter T–195/GRC–19.

(5) *Mounting MT–9851/GRC–19.* No packaging required.

c. Packing. Pack the components in wooden boxes as follows:

(1) Place the following items in box No. 1: Radio Transmitter T–195/GRC–19, Case CY–1451/GRC–19, Cable Assembly CG–1127/U, Cable Assembly CX–1599/U, Cable Assembly CX–1852/U, Cable Assembly CX–2583/U, Radio Receiver R–392/URR, Case CY–1298/URR, and technical manuals. The box should be 18 inches high, 50 inches wide, and 18 inches deep.

(2) Place the Bag CW–206/GR in box No. 2. The box should be 12 inches high, 44 inches wide, and 10 inches deep.

(3) Place Mounting MT–851/GRC–19 in box No. 3. Block the mounting within the box with wooden blocks nailed to the inside of the box to prevent movement. The box should be 4 inches high, 36 inches wide, and 16 inches deep.

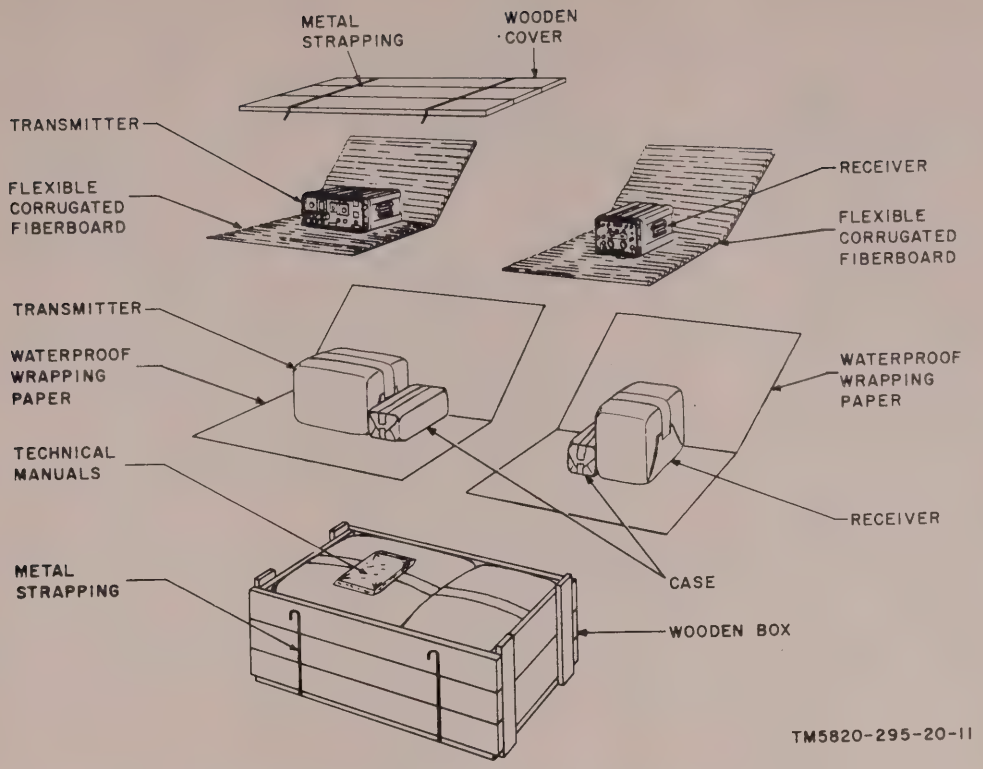

Figure 11. Transmitter, receiver, and literature, repackaging diagram.

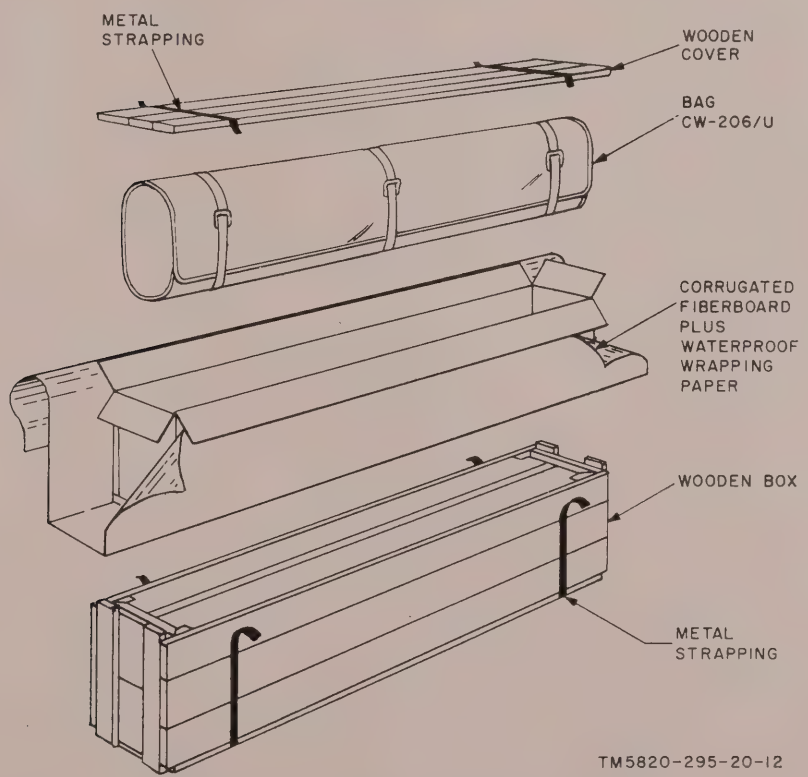

Figure 12. Bag, repackaging diagram.

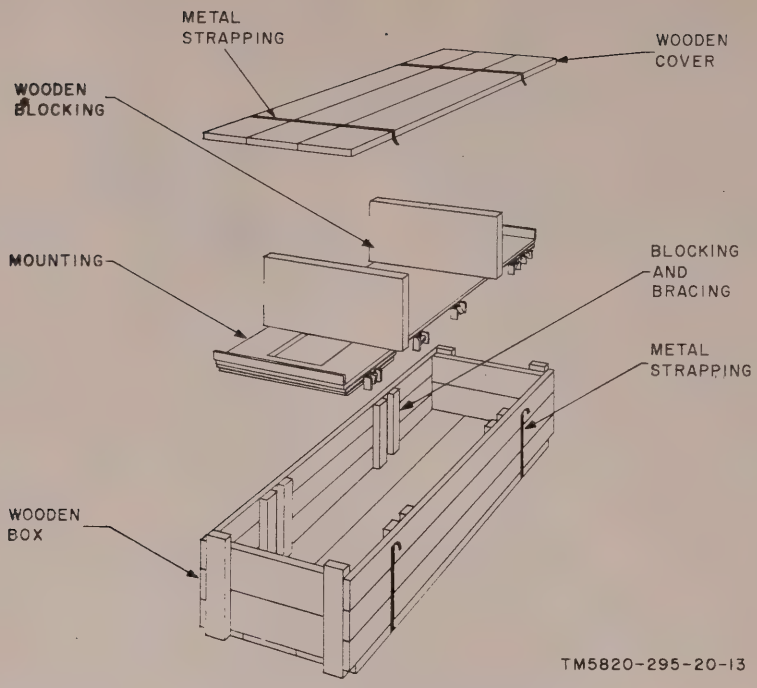

Figure 13. Mount, repackaging diagram.

APPENDIX I
REFERENCES

The following is a list of references applicable and available to the unit repairman of Radio Set AN/GRC–19:

SB 38–100	Preservation, Packaging and Packing Material, Supplies, and Equipment Used by the Army.
TM 11–806	Radio Transmitter T–195/GRC–19.
TM 11–858	Radio Receiver R–392/URR. .
TM 11–5820–295–10	Operator's Manual, Radio Set AN/GRC–19.
TM 11–5820–295–10P	Operation Maintenance Repair Parts and Special Tools List: Radio Set AN/GRC–19.
TM 11–5820–295–20P	Organization Maintenance Repair Parts and Special Tools List and Maintenance Allocation Chart for Radio Set AN/GRC–19.
TM 11–5820–334–10P	Operator's Maintenance Repair Parts and Special Tools List: Receiver, Radio R–392/URR.
TM 11–5820–334–20P	Organizational Maintenance Repair Parts and Special Tools List and Maintenance Allocation Chart: Receiver, Radio R–392/URR.

GLOSSARY

Section I. ABBREVIATIONS

af	audio frequency	hf	high frequency
agc	automatic gain control	hv	high voltage
ampl	amplifier	if	intermediate frequency
AWG	American Wire Gage	kc	kilocycle
bfo	beat-frequency oscillator	mc	megacycle
fsk	frequency-shift keyed	rf	radiofrequency

Section II. DEFINITIONS OF UNUSUAL TERMS

Autotune—The name applied to an electromechanical system which automatically positions a shaft to a predetermined setting.

Frequency-shift keying—A method of radioteletype keying; the carrier frequency is shifted to a slightly different frequency under certain conditions.

Sidetone—An audio-frequency signal used for monitoring transmissions.

Subchassis—The name applied to a removable assembly which performs a major function in the receiver or transmitter.

By Order of *Wilber M. Brucker*, Secretary of the Army:

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44–437 (2)
44–445 (2)
44–447 (2)
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44–549 (2)
55–11 (2)
55–12 (2)
55–38 (2)
55–157 (2)
57 (2)
57–5 (2)

NG: State AG (3); Units—Same as Active Army except allowance is one copy to each unit.

USAR: None.

For explanation of abbrevitions used, see AR 320–50.

☆ U. S. Government Printing Office: 1960—522585/44